SECTION 35: LIGHTING AND ELECTRICAL SYSTEMS

35-01 SCOPE. The Work shall consist of furnishing, installing and testing luminaires containing an integral ballast system, clear high-pressure sodium lamps; photoelectric cells; pull boxes; pole numbers; electrolier standards, mast arms and foundations; in-line fuses; conduit and cable and all other materials and appurtenances in accordance with the Plans and these Special Provisions. The end result shall be a system complete and in operation to the satisfaction of the Engineer.

35-02 MATERIALS AND CONSTRUCTION.

35-02.01 General. All materials delivered to the job shall be new, best quality of their respective grades, in accordance with these Special Provisions and packed in their original sealed containers. All materials to be installed shall bear the Underwriters Laboratories, Inc., UL Label.

The Contractor shall use materials mentioned in these Special Provisions as standard, or an approved equal from the latest edition of the City's Approved Material List, and in no case will a substitute be allowed without written approval of the Engineer.

All Work shall be in compliance with the requirements of the applicable sections of the Standard Specifications and the City of Mountain View Standard Details. In case of conflict, the higher requirement shall govern.

All Work and material shall be protected at all times. Pipe openings shall be closed with protective caps during installation and all materials shall be covered and protected against dirt, water and mechanical or other injury. All materials damaged during course of construction shall be replaced or repaired to original condition by the Contractor.

The Contractor shall not allow or cause any of his Work to be covered up or enclosed until it has been inspected and approved by the Engineer. Should any of the Work be enclosed or covered up before such inspection, the Contractor shall, at his own expense, uncover the Work and, after it has been inspected and approved, make all repairs with such material as may be necessary to restore all Work to its original and proper condition.

35-02.02 Foundations. Foundations shall conform to Section 86-2.03, "Foundations," of the Standard Specifications and with the Standard Details except as modified herein. The top four inches (4") of the foundation shall not be placed until the standard is erected and leveled.

35-02.03 Electrolier Standards. Electrolier standards shall conform to Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications and with the Standard Details except as modified herein. See Section 35-02.08, "Painting," of these Standard Provisions for painting requirements. Allen head screws shall be used in all electrolier hand holes covers.

a. Type "B" Street Light. The lighting post shall be all aluminum, one-piece construction, with a classic tapered and fluted base design. The shaft shall be five inches (5") diameter fluted. The post shall be catalog No. NY11FMOD/17MODPT18-CA/BK manufactured by Antique Street Lamps, Inc., or WPBBH 11'-6"-EF50 manufactured by Western Lighting, or an approved equal.

The base shall be heavy wall, copper free, cast aluminum produced from certified ASTM 356.1 ingot per ASTM B-179-95a or ASTM B26-95. The straight shafts shall be extruded aluminum, ASTM 6061 alloy, heat-treated to a T6 temper. A door shall be provided in the base for anchorage and wiring access. A grounding screw shall be provided inside the base opposite the door. The shaft shall be double welded to the base casting and shipped as one piece. The shaft shall be circumferentially welded inside the base casting at the top of the access door, and externally where the shaft exits the base. All exposed welds shall be ground smooth. All welding shall be per ANSI/AWS D1.2-90.

The acorn styled luminaire shall consist of a decorative luminaire base with an integral globe holder/ballast housing and an acorn shaped globe. The luminaire shall be catalog No. AA25BFMOD/BK-S100/120-III-PEC manufactured by Antique Street Lamps, Inc., or FXS2PT30 manufactured by Western Lighting, or an approved equal. The luminaire base, ballast housing and globe holder shall be heavy wall, copper free, cast aluminum produced from certified ASTM 356.1 ingot per ASTM B-179-95a or ASTM B26-95. Globe material shall be clear textured polycarbonate. Internal refractors shall be boroscilicate glass with an IES Type 3 distribution. Finials shall be injection-molded polycarbonate.

Luminaires shall be furnished with an H.I.D. ballast, socket assembly, photoelectric control and lamp. Luminaire shall be UL listed and labeled as suitable for wet locations. Sockets shall be glazed porcelain, medium base, with a copper alloy nickel-plated screw shell and center contact. Ballast shall be core and coil, high power factor, regulating type.

The luminaire shall mount on a 3" O.D. tenon with six 1/4" diameter socket set screws. The globe shall be secured to the luminaire by four 1/4" diameter socket set screws. The ballast and socket assembly shall be furnished with a quick disconnect plug and mount on a removable ballast plate. The ballast plate shall be removed by loosening a thumbscrew.

Lamps shall be General Electric Company LU70/DX/MED or wattage as specified on the Plans or the project Specifications. Equivalent lamps manufactured by Sylvania or Westinghouse are acceptable but shall be from the latest edition of the City's Approved Material List.

All metal finishes shall be black. All hardware shall be tamper-resistant stainless steel. Anchor bolts shall be completely hot dip galvanized.

35-02.04 Conduit. Conduits shall conform to Section 86-2.05, "Conduit," of the Standard Specifications except as modified herein.

A run of conduit installed without conductors and having a bend of ninety degrees (90°) or more shall have installed within the entire run a No. 12 AWG copper pull wire. The ends of all empty conduits shall be capped.

Connections from metal conduit to nonmetallic conduit shall be made at pull boxes or a minimum of four inches (4") inside electrolier foundations so that the connection will be completely covered by concrete.

Excavating and backfilling shall conform to Section 86-2.01, "Excavating and Backfilling," and Section 86-2.02, "Removing and Replacing Improvements," of the Standard Specifications except as modified herein. The maximum width of trench shall be eight inches (8"). Trenching shall not occur in street pavement unless otherwise specified. "Initial Backfill" shall be sand. "Subsequent Backfill" shall be native material free of stones, hard pan lumps, broken concrete or paving material. The backfill material shall be brought to the elevation of the bottom of the subbase material of the sidewalk or pavement. Backfill shall be placed in layers not exceeding eight inches (8") in depth and shall be thoroughly tamped in such a manner as to prevent future settlement. Should the Contractor elect to use all sand backfill, the eight-inch (8") layer construction may be omitted and compaction may be obtained by ponding.

Conduits to be installed under street pavement shall be one and one-half inch (1-1/2") rigid steel conduit conforming to the requirements in Publication UL 6 for Rigid Metallic Conduit. The zinc coating shall be in accordance with ASTM Designation A239 unless otherwise specified.

Conduits to be installed other than under street pavement shall be one and one-half inch (1-1/2") rigid steel conduit or Schedule 40 rigid plastic (nonmetallic) conduit conforming to the requirements in the Underwriters Laboratories Standard for Rigid Nonmetallic Conduit (Publication UL 651). Rigid plastic conduit connections shall be of the solvent weld type. See Paragraph 35-02.07, "Bonding and Grounding," of these Standard Provisions for grounding in plastic conduit.

Cutting and machining of conduit shall be in accordance with manufacturer's recommendations. Preassembly of sections of conduit shall not be permitted except where jacking is required.

When jacking is required, a galvanized metal pipe sleeve conforming to Section 86-2.05, "Conduit," of the Standard Specifications of sufficient diameter to contain the conduit shall be jacked across the required distance. The conduit shall then be threaded through the pipe and connected to the conduit system.

Trench-laid conduit installed outside of street pavement shall be placed not less than eighteen inches (18") below the surface of the ground or sidewalk. The conduit shall be laid over two inches (2") of uniformly spread sand. Native material may be used for backfill around and above the conduit.

Trench-laid conduit installed under street pavement shall be placed not less than thirty inches (30") below the pavement surface. The conduit shall be laid over two inches (2") of uniformly spread sand. A minimum of four inches (4") of the same type of material shall be placed over the conduit. The remaining trench may be backfilled with native material up to subgrade.

The minimum cover requirements for trench-laid conduit installed under street pavement may be reduced to eighteen inches (18") if the conduit is backfilled with controlled density fill (CDF). The CDF shall meet the requirements as specified in these Standard Provisions. CDF shall be placed to three inches (3") below the pavement surface. The top three inches (3") of the trench shall be backfilled with asphalt concrete produced from commercial quality paving asphalt and aggregates. Prior to spreading asphalt concrete, paint binder (tack coat) shall be applied as specified in these Standard Provisions. Spreading and compacting of asphalt concrete shall be performed by any method which will produce an asphalt concrete surface of uniform smoothness, texture and density.

Conduit installed under street pavement by means of pushing, jacking or boring shall be placed not less than thirty inches (30") below the pavement surface.

35-02.05 Pull Boxes. Pull boxes shall conform to Section 86-2.06, "Pull boxes," of the Standard Specifications and with the Standard Details.

A pull box shall be installed adjacent to all electrolier standards. The pull box shall be a No. 3-1/2 or as otherwise noted on the Plans.

35-02.06 Conductors and Wiring. Conductors and wiring shall conform to Section 86-2.08, "Conductors," and Section 86-2.09, "Wiring," of the Standard Specifications. The insulation for No. 10 and larger conductors shall be one of the following:

a. Type TW polyvinylchloride conforming to the requirements of ASTM Designation D2219.

b. Type THW or THWN polyvinylchloride.

Splicing shall conform to the following methods as specified in Section 86-2.09, "Wiring," of the Standard Specifications or approved equal:

A standard C-shaped compression connector and insulated per method B or the "Wiring Details and Fuse Rating," Detail ES-13, of the Department of Transportation's Standard Plans.

Multiple lighting conductors shall only be spliced in pull boxes.

Street light cable shall be stranded copper conductor of sizes as specified on the Plans or in the Special Provisions. Minimum conductor sizes shall be No. 8 AWG and No. 10 AWG within the standard. Conductors shall be of consistent wire gauge and insulation unless otherwise specified. Conductors shall have a minimum of two feet (2') of slack in all pull boxes that are located next to the base of each electrolier and at each splice.

A 10-amp in-line fuse shall be installed in the base of each electrolier and be accessible through the hand hole. Fuse holders shall conform to Section 86-2.095, "Fused Splice Connectors," of the Standard Specifications.

35-02.07 Bonding and Grounding. Bonding and grounding shall conform to Section 86-2.10, "Bonding and Grounding," of the Standard Specifications except as modified herein. Bonding connections shall be made with No. 4 AWG bare copper wire or with copper ground straps of equal cross-sectional area.

The ground electrode for the electrolier standards shall be as shown on the Standard Details.

Where conductors and wires are installed in nonmetallic conduits, a properly sized, green insulated, No. 8 AWG minimum, copper wire (equipment grounding wire) shall be installed continuously in all circuits from the point of service to each pull box and light standard. The ground wire shall be properly grounded in the pull box located closest to the service point in accordance with Section 86-2.10," Bonding and Grounding," of the Standard Specifications and Paragraph 35-02.10, "Service Connection," of these Standard Provisions.

35-02.08 Painting. Painting shall conform to Section 86-2.16, "Painting," of the Standard Specifications except as modified herein. The prime coats, two required, shall be red iron oxide type primer or approved equal.

The finish coats shall be dark olive green industrial enamel finishes as manufactured by Tresco Paint Manufacturing Company, No. 1372-SA115-18DK or approved equal. The finish coat shall be applied in not less than two (2) applications.

Factory finish on new equipment will be acceptable if of proper color, and if equal in quality to the specified finish. The final finish coat on standards and mast arms may be applied in the field.

Failure to comply with any part of the foregoing painting specifications shall be sufficient cause for the City to require the Contractor to completely remove all applied coats and reapply required prime and finish coats in accordance with these Standard Provisions.

The Contractor shall provide protective devices such as tarps, screens or covers, as necessary, to protect curb and gutters, glassware, adjacent buildings, parked automobiles, and other property or persons from all cleaning and painting operations. Paint or paint stains, which result in an unsightly appearance on surfaces not designated to be painted, shall be removed or obliterated by the Contractor at his expense and to the satisfaction of the Engineer.

When pole painting is complete, the Contractor shall furnish and install pole identification plates, except on Type "B" streetlight poles. On Type "B" streetlight poles, the Contractor shall furnish and install self-adhesive reflective numbers (white on black) sized two and one-half inch (2-1/2") by one and one-half inch (1-1/2") with one-quarter inch (1/4") spacing between letters/numbers and approved by the City. The City will assign pole identification numbers.

35-02.09 Luminaires. Luminaires shall conform to Section 86-6.01, "High-Intensity-Discharge Luminaires," of the Standard Specifications except as modified herein.

Luminaires shall consist basically of an aluminum housing, photoelectric control receptacle, reflector, prismatic refractor, integral ballast and an adjustable socket capable of producing IES Types II or III. Type IV shall be provided only when required. Glare shields shall not be installed. Distribution type shall be medium, semi-cutoff or as specified on the Plans or Special Provisions. Luminaires, complete with lamps, shall be installed on the mast arms in the proper orientation to produce the desired light pattern and shall be completely assembled and connected to the conductor. Each refractor shall be acrylic unless noted otherwise. The integral ballast need not be mounted on a down-opening door.

a. Multiple Circuits

Luminaires for multiple circuits shall have Mogul multiple sockets and internal ballast of the regulator type capable of operating from a multiple 120- or 240-volt circuit as noted on the Plans. The high-pressure sodium luminaires shall be as listed below or an approved equal from the latest edition of the City's Approved Material List.

Lamp Wattage	Primary Voltage	Thomas & Betts	General Electric
70	120	113-562E2-6000A0	M2AR07S1H2AMS21
70	240	113-563E2-6000A0	M2AR07S3H2AMS21
100	120	113-56213-6000A0	M2AR10S1M2AMS31
100	240	113-56313-6000A0	M2AR10S3M2AMS31
150	120	113-56263-6000A0	M2AR15S1M2AMS31
150	240	113-56363-6000A0	M2AR15S3M2AMS31
200	120	125-062J3-0000A0	M2AR20S1A2GMS31
200	240	125-063J3-0000A0	M2AR20S3A2GMS31

b. Lamps. Each luminaire shall be equipped with a clear high-pressure sodium lamp of the following ANSI Code Number.

Lamp Wattage	ANSI Code No.
70	S62-ME-70
100	S54-SB-100
150	S55-SC-150
200	S66-MN-200

c. Photoelectric Control. Photoelectric control shall conform to Section 86-6.07, "Photoelectric Controls," of the Standard Specifications except as modified herein.

All photoelectric control shall be Type IV. A photoelectric unit shall be supplied for each luminaire, connected to the same voltage as the luminaire.

35-02.10 Service Connection. Electrical service installation and materials shall conform to the requirements of the serving utility. Service equipment shall be installed as soon as possible to enable the utility to schedule work well in advance of the completion of the project. Service connections for electroliers served by underground electrical systems will be made at the nearest Pacific Gas and Electric

Company secondary box. The Contractor shall provide conduit and wire from the secondary box to the electrolier.

When a circuit serviced from an underground secondary box serves more than one electrolier, the circuit shall be fused at the first pull box from the secondary box. Pull box shall be sized No. 31/2 unless otherwise noted.

The circuit fuse shall be 40-amp for No. 8 AWG wire and shall be installed in an in-line, waterproof holder. Fuses for larger wires will be sized by the Engineer. Both hot legs of 240-volt circuits shall be fused.

Only the one hot leg of 120-volt circuits shall be fused. A ground electrode and ground clamp conforming to Section 86-2.10, "Bonding and Grounding," of the Standard Specifications shall be installed in the pull box in which the circuit is fused. The purpose of the ground electrode is to facilitate grounding the circuit when the fuse holder is disconnected, thus eliminating the possibility of energizing the circuit while it is being repaired.

Service connections for electroliers served by overhead electrical systems will be made at a junction box at the base of the service riser pole. The Contractor shall provide the junction box and conduit and wire from the junction box to the nearest electrolier. In all cases where the service is from a riser pole, the Contractor shall install a ground electrode and shall fuse the circuit in this adjacent junction box in accordance with the above requirements. Junction box shall be sized No. 31/2 or larger.

All service connections will be made by Pacific Gas and Electric Company. The Contractor shall bear all costs charged by Pacific Gas and Electric Company for the service connection.

35-02.11 Field Tests. Field tests shall conform to Section 86-2.14, "Testing," of the Standard Specifications except as modified herein.

The Contractor shall be responsible for maintaining the lighting system during the functional test period.

35-02.12 Pole Identification Plates. The City will assign pole identification numbers. The contractor shall furnish and install pole identification plates. The letters/numbers shall be white reflective, Highway Gothic "B", 1-3/4" tall, spaced 5/8" apart. The letters/numbers shall be mounted vertically on 3" x 12" x 0.080 aluminum plates with 1/2" radius corners and 5/16" holes punched 1/2" in from the top and bottom. The color of the plates shall be Bottle Green 3M #7725-276 pressure sensitive for installation on green poles; and black pressure sensitive for installation on black poles.

35-03 MEASUREMENT.

35-03.01 Electroliers. Electroliers shall each be measured as one complete installed unit in operable condition, including concrete foundation, electrolier standard with mast arm, luminaire complete with ballast and lamp, photoelectric unit, conductors and wiring, including in-line fuse at hand hole, bonding and grounding, and pole identification numbers and plates.

35-03.02 Conduit. Conduit shall be measured horizontally by the linear foot through all phases of the electrical underground street lighting system.

35-03.03 Pull Boxes. Pull boxes shall be measured as one complete installed unit, including the rock and concrete base, precast sections, bonding and grounding.

35-03.04 Conductors and Wiring. Conductors and wiring shall be measured horizontally by the linear foot for each pair of wires through pull boxes. Conductors and wiring in electroliers shall be measured as part of the unit in which they are installed.

35-03.05 Photoelectric Control. Photoelectric controls shall be included as part of electroliers and will not be measured for payment.

35-03.06 Service Connection. Service connection, including fusing of the circuit, installation of a ground electrode and clamp and Pacific Gas and Electric Company connection charges, shall be considered included in other items of Work and will not be measured for payment. Pull boxes installed as a requirement of the service connection will be paid for under Paragraph 35-04.04, "Pull Boxes," of these Standard Provisions.

35-03.07 Testing. Testing shall be considered as included in other items of work and will not be measured for payment.

35-04 PAYMENT.

35-04.01 Electroliers. The Contract price paid per each electrolier shall constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all Work, including excavation and placing concrete foundations, erecting the standard with mast arm, installing luminaires complete with ballast and lamp, photoelectric unit wiring and conductors including in-line fuse, bonding, grounding and all other incidental work required to install the electrolier complete as required in the Special Provisions, shown on the Plans and specified herein.

35-04.02 Conduit. The Contract price paid per linear foot for each type or size of conduit shall constitute full compensation for furnishing all labor, materials (including fittings and couplings), tools and equipment, and doing all Work, including excavation, concrete caps, sand, casing and jacking as required to install the conduit complete as required in the Special Provisions, shown on the Plans and specified herein.

35-04.03 Conductors and Wiring. The Contract price paid per linear foot for each pair of conductors and wiring shall constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all Work required to install the conductors complete as required in the Special Provisions, shown on the Plans and specified herein.

35-04.04 Pull Boxes. The Contract unit price paid per each pull box shall constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all Work, including excavating and placing base material and concrete and all other incidental work required to install the pull boxes complete as required in the Special Provisions, shown on the Plans and specified herein.